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In re the application of:

Toshihito KIDO et al.

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Art Unit: 2612

Examiner: J. Villecco

For: DIGITAL CAMERA INCLUDING POWER SUPPLY CONTROLLER
RESPONSIVE TO CONNECTION DETECTION

DECLARATION AND VERIFIED TRANSLATION

Commissioner for Patents
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Sir:

I, Kanzo Komazawa, a translator working for SANO PATENT OFFICE, having my business office at Tenmabashi-Yachiyo Bldg. Bekkan, 2-6, Tenmabashi-Kyomachi, Chuo-Ku, Osaka-Shi, Osaka 540-0032, Japan, hereby declare and say:

That I am thoroughly conversant with both the Japanese and English languages; and that the attached document represents a true English translation of Japanese Patent Application No. H10-216709 filed in the JPO on July 31, 1998, for which priority benefits are claimed under 35 U.S.C. §119.

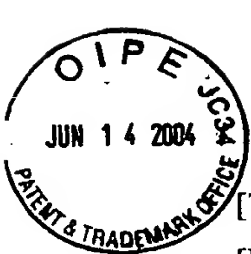
I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so

made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Signed this 11th day of June, 2004.

Signature: K. Komazawa

Name: Kanzo KOMAZAWA



JP App. H10-216709

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[Title of the Invention] DIGITAL CAMERA

[Claims]

5 [Claim 1]

 A digital camera comprising an image sensor for converting an imaged subject image into an electrical signal, a taking lens for imaging the subject image on the image sensor, an image processor for forming image data by performing predetermined processing on the electrical signal obtained from the image sensor and a recorder for recording the image data
10 formed by the image processor, an image-sensing unit including at least the taking lens and the image sensor being detachable from a camera body including at least the recorder,

 wherein the digital camera further comprises detecting means for detecting a connection state of the image sensing unit to the camera body and controlling means for controlling, according to a result of detection by the detecting means, feeding of electric power
15 to a circuit provided, as relevant to the image sensing unit, inside the camera body.

 [Claim 2]

 A digital camera as claimed in claim 1, wherein the digital camera comprises a flash control circuit for effecting emission of flash, and, when the detecting means detects that the image sensing unit is not connected to the camera body, the controlling means so controls that
20 no electric power is fed to the flash control circuit.

 [Claim 3]

 A digital camera as claimed in claim 1, wherein the digital camera comprises a flash control circuit for effecting emission of flash and an extension cable for connecting the image sensing unit to the camera body, and, when the detecting means detects that the image sensing unit is connected to the camera body via an extension cable longer than a predetermined length,
25 the controlling means so controls that no electric power is fed to the flash control circuit.

 [Claim 4]

 A digital camera comprising an image sensor for converting an imaged subject image into an electrical signal, a taking lens for imaging the subject image on the image sensor, an
30 image processor for forming image data by performing predetermined processing on the electrical signal obtained from the image sensor and a recorder for recording the image data formed by the image processor, an image-sensing unit including at least the taking lens and the image sensor being detachable from a camera body including at least the recorder, an interface

for permitting connection of an external device to the digital camera being connectable in place of the image sensing unit,

wherein the digital camera further comprises detecting means for detecting a connection state of the image sensing unit and the interface to the camera body and controlling means for controlling, according to a result of detection by the detecting means, feeding of electric power to a circuit provided, as relevant to the image sensing unit or the interface, inside the camera body.

[Claim 5]

A digital camera as claimed in claim 4, wherein, when the detecting means detects that the image sensing unit or the interface is not connected to the camera body, the controlling means so controls as to shut off the feeding of electric power to a circuit relevant only to the image sensing unit or the interface.

[Claim 6]

A digital camera as claimed in claim 4, wherein the digital camera comprises a power supply for feeding electric power from a power source provided within or connected to the camera body only to a circuit within the image sensing unit or to a circuit within the interface, and, when the detecting means detects that nothing is connected to the camera body, the controlling means so controls that no electric power is fed to the power supply.

[Claim 7]

A digital camera as claimed in claim 4, wherein the digital camera comprises a plurality of power supplies for feeding electric power from a power source provided within or connected to the camera body to individual circuits constituting the digital camera, and the controlling means so controls as to feed electric power only to those among the plurality of power supplies which correspond to a result of detection by the detecting means.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a digital camera comprising an image sensor for converting an imaged subject image into an electrical signal, a taking lens for imaging the subject image on the image sensor, an image processor for forming image data by performing predetermined processing on the electrical signal obtained from the image sensor, and a recorder for recording the image data formed by the image processor.

[0002]

[Prior Art]

As a digital camera, in recent years, one has been known in which an image sensing unit is detachably attached to the camera body, interfaces for various apparatuses as accessories connectable to the camera body are provided in addition to the image sensing unit, and not only shot images are recorded as image data but also its function can be extended by connecting an accessory to the camera body in accordance with the purpose. Digital cameras are becoming widespread, for example, as a peripheral apparatus of personal computers (PCs).

[0003]

[Problems to be Solved by the Invention]

However, such conventional digital cameras are inconvenient to use and inferior in portability because in the digital cameras, the power source for driving circuits in an image sensing unit or an accessory is provided for each image sensing unit and each accessory and this increases the total number of necessary batteries. Moreover, although some digital cameras can be supplied with power from the commercial AC power source through an AC adapter when used indoors, even in such a case, the operability is inferior because it is necessary to unplug the AC adapter and plug another AC adapter every time the interface is changed.

[0004]

To solve this problem, a digital camera has been proposed in which power is supplied to the circuits in the image sensing unit and an accessory connected to the camera body from the camera body by a power source provided in or connected to the camera body. In this case, since the power to be supplied varies among the circuits in the image sensing unit and accessories, a plurality of power source portions for supplying power suitable for each circuit from the power source are incorporated. Conventionally, since power is supplied to all the circuits, including the plurality of power source portions, in the camera body when the camera is activated, power consumption is great.

[0005]

Accordingly, an object of the present invention is to provide a digital camera realizing reduction in power consumption.

[0006]

[Means for Solving the Problem]

To achieve the above object, according to the present invention, a digital camera

comprises an image sensor for converting an imaged subject image into an electrical signal, a taking lens for imaging the subject image on the image sensor, an image processor for forming image data by performing predetermined processing on the electrical signal obtained from the image sensor, and a recorder for recording the image data formed by the image processor.

5 Here, an image-sensing unit including at least the taking lens and the image sensor is detachable from a camera body including at least the recorder. Moreover, the digital camera further comprises detecting means for detecting the connection state of the image sensing unit to the camera body and controlling means for controlling, according to the result of detection by the detecting means, the feeding of electric power to a circuit provided, as relevant to the
10 image sensing unit, inside the camera body.

[0007]

Alternatively, according to the present invention, a digital camera comprises an image sensor for converting an imaged subject image into an electrical signal, a taking lens for imaging the subject image on the image sensor, an image processor for forming image data by
15 performing predetermined processing on the electrical signal obtained from the image sensor, and a recorder for recording the image data formed by the image processor. Here, an image-sensing unit including at least the taking lens and the image sensor is detachable from a camera body including at least the recorder, and an interface for permitting connection of an external device to the digital camera is connectable in place of the image sensing unit. Moreover, the
20 digital camera further comprises detecting means for detecting the connection state of the image sensing unit and the interface to the camera body and controlling means for controlling, according to the result of detection by the detecting means, the feeding of electric power to a circuit provided, as relevant to the image sensing unit or the interface, inside the camera body.

[0008]

25 Here, in a case where there are provided a plurality of power supplies for feeding electric power to the circuits provided within devices (such as the image sensing unit and accessories) that can be connected to the camera body, when a particular device is connected, only the one among the plurality of power supplies which feeds electric power to the actually connected device needs to be driven. Moreover, also with respect to other circuits,
30 depending on what kind of device is connected to the camera body, or whether any device is connected to the camera body or not, that is, depending on the connection state of a device connectable to the camera body, some circuits cannot function and thus do not need to be driven (for example, in a state where the image sensing unit is not connected, as a connectable

device, to the camera body, shooting cannot be performed, and thus a circuit for effecting emission of flash is among such circuits).

[0009]

The present invention has been devised out of the above considerations. Specifically, with the constructions according to the invention described above, it is possible to control, according to the connection state of devices connectable to the camera body, the feeding of electric power to the circuits provided inside the camera body as relevant to the connectable devices. Since what circuits to leave undriven differ according to the connection states of devices connectable to the camera body, those constructions permit to shut off the feeding of electric power to circuits that do not need to be driven.

[0010]

[Embodiment]

A digital camera according to the present invention will be described with reference to the drawings. A digital camera 1 according to an embodiment of the present invention has a box-shaped camera body 2 and a rectangular-parallelepiped-shaped image sensing unit 3 as illustrated in Fig. 1 showing a front view of the appearance thereof. First, the camera body 2 will be described. On the front surface of the camera body 2, a grip 4 is disposed in an appropriate position in a left end part, and a built-in flash 13 is disposed in an appropriate upper position in a right end part. On the top surface of the camera body 2, switches 6 and 7 for advancing frames when recorded images are reproduced are disposed substantially in the center.

[0011]

The switch 6 is for advancing frames of recorded images in a direction that increases the frame number, that is, a direction of the order of shooting (hereinafter, the switch 6 will be referred to as "UP switch"). The switch 7 is for advancing frames of recorded images in a direction that decreases the frame number (hereinafter, the switch 7 will be referred to as "DOWN switch"). An erasing switch D for erasing image data recorded on a memory card 8 is disposed on the right side of the DOWN switch 7 when viewed from the front, and a shutter button 9 is disposed on the left side of the UP switch 6.

[0012]

On the back surface of the camera body 2, as shown in Fig. 2, an LCD 10 for performing monitor display (corresponding to the viewfinder) of shot images and reproduction display of recorded images is disposed substantially in the center in the left end part. Below

the LCD 10 are disposed a compression rate setting slide switch 12 for switching the compression rate K of image data to be recorded on the memory card 8 and a power switch PS for turning on and off the activation of the camera body 2.

[0013]

5 The digital camera 1 has the following modes for flash light emission: "auto flash mode" in which the built-in flash 13 automatically fires in accordance with the subject brightness; "forced flash mode" in which the built-in flash 13 is forced to fire irrespective of the subject brightness; and "flash cancel mode" in which the built-in flash 13 is inhibited from firing. Every time the FL(flash) mode setting switch 11 is depressed, the "auto flash mode", the
10 "forced flash mode" and the "flash cancel mode" are cyclically switched so that one of the modes is selected.

[0014]

 In the digital camera 1, the compression rate K can be selected between 1/8 and 1/20. For example, when the compression rate setting switch 12 is slid rightward, the compression
15 rate K is set to 1/8, and when the switch 12 is slid leftward, the compression rate K is set to 1/20. While the compression rate K can be switched between two compression rates in this embodiment, the digital camera 1 may be designed so that the compression rate K can be selected from among three or more compression rates.

[0015]

20 A shooting/reproduction mode setting switch 14 for switching between a "shooting mode" and a "reproduction mode" is disposed in an upper part at the right end of the back surface of the camera body 2. The shooting mode is for performing shooting. The reproduction mode is for performing reproduction display of shot images recorded on the memory card 8 on the LCD 10. The shooting/reproduction mode setting switch 14 is also a
25 two-position slide switch. For example, when the switch 14 is slid rightward, the reproduction mode is set, and when the switch 14 is slid leftward, the shooting mode is set.

[0016]

 On the bottom surface of the camera body 2, as shown in Fig. 3, a card chamber 16 for the memory card 8 and a battery chamber 17 are provided. The openings of the chambers 16
30 and 17 are closed by a clamshell-type lid 15. The digital camera 1 of this embodiment is designed to use as the drive source four AA batteries connected in series or commercial AC power by connecting an AC adapter.

[0017]

In summary, the camera body 2 mainly performs, after performing a predetermined signal processing on the image signals captured by the subsequently-described image sensing unit 3, processings such as display of the image signals on the LCD 10, recording of the image signals onto the memory card 8 and transfer of the image signals to a personal computer through an interface described later.

[0018]

Subsequently, the image sensing unit 3 will be described. As shown in Fig. 1, the image sensing unit 3 is attached to the right side surface of the camera body 2 when viewed from the front so as to be detachable and rotatable within a plane parallel to the right side surface. The image sensing unit 3 has an image sensing unit main body 31A of a longitudinally elongated rectangular parallelepiped shape having a length substantially the same as the along-the-height length of the camera body 2 and having a depth length substantially the same as that of the camera body 2 as shown in Fig. 2. An attaching member 31B used for attaching the image sensing unit 3 to the camera body 2 is provided on one side surface of the image sensing unit main body 31A.

[0019]

In the image sensing unit 3, since the image sensing unit main body 31A is a rectangular parallelepiped shape elongated in one direction and can be set along the side surface of the camera body 2 when the camera 1 is not used, a zoom lens elongated in the direction of the optical axis can be employed without the depth size of the digital camera 1 being increased. A mechanism of attaching the image sensing unit 3 to the camera body 2 by the attaching member 31B will be described later.

[0020]

In the image sensing unit main body 31A, as shown in Fig. 4, a standard macro zoom lens 301 is disposed. An image sensing circuit 302 having a CCD color area sensor (hereinafter, referred to as "CCD") 303 is disposed in an appropriate position behind the standard macro zoom lens 301. Moreover, a light adjust circuit 304 having a sensor 305 for receiving reflected flash light from the subject is disposed in an appropriate position in the image sensing unit 3. The sensor 305 and an AF (automatic focusing) sensor 306 for phase difference detection are disposed in appropriate positions respectively on the front end surface of the attaching member 31B. As shown in Fig. 2, an unlocking lever 315 is provided for enabling the detachment of the image sensing unit 3 from the camera body 2.

[0021]

Subsequently, the mechanism of attaching the image sensing unit 3 to the camera body 2 will be described. On the right side surface of the camera body 2 when viewed from the front, as shown in Fig. 5, a connecting plate 23 to which the image sensing unit 3 is detachably attached is rotatably disposed within a plane parallel to the right side surface. By the rotation of the connecting plate 23, the image sensing unit 3 attached to the camera body 2 rotates with respect to a rotation reference position A in a range of substantially ± 90 degrees. As shown in Fig. 6, an attaching surface 308 of the attaching member 31B has a rectangular hole 309 having four claws 310a to 310d in appropriate positions at the periphery. The image sensing unit 3 is attached to the camera body 2 by fitting the connecting plate 23 in the hole 309.

[0022]

On the attaching surface of the connecting plate 23, a connecting terminal group 234 having a plurality of terminals is disposed, and in the hole 309 of the attaching member 31B, connecting terminal groups 334 are disposed so as to be opposed to the connecting terminal groups 234 on the attaching surface of the connecting plate 23. When the image sensing unit 3 is attached to the camera body 2 through the connecting plate 23, the image sensing unit 3 and the camera body 2 are electrically connected through the connecting terminal groups 234 and 334.

[0023]

In the connecting plate 23, rectangular concave portions 231a and 231b are provided in appropriate positions at both long sides, and grooves are formed at both corners on one side and positions continuous with the concave portions 231a and 231b on a surface where the connecting terminal groups 234 are not disposed (hereinafter, this surface will be referred to as "rear surface") to provide engagement portions 232a, 232b, 232c and 232d with which the claws 310a to 310d of the attaching member 31B are engaged, respectively. On the surface where the connecting terminal groups 234 are disposed (hereinafter, this surface will be referred to as "obverse surface"), a groove is formed in an appropriate position on a long side where the concave 231a is formed to provide an engagement portion 233 in which a key 311 of the attaching member 31B is fitted.

[0024]

The attaching member 31B of the image sensing unit 3 is attached to the connecting plate 23 of the camera body 2 in the following manner: First, the attaching surface 308 of the attaching member 31B is placed in parallel with the connecting plate 23 so that the claws 310c and 310d of the hole 309 are opposed to the concave portions 231a and 231b of the

connecting plate 23, respectively, and then, the attaching member 31B is pressed against the connecting plate 23. When this is done, the claws 310c and 310d are fitted in the concave portions 231a and 231b, and the key 311 is pushed by the surface of the connecting plate 23 to move to an unlocking position against the pressure of a spring 312 (Fig. 7) and the attaching member 31B is pushed until the rear surface of the connecting plate 23 is flush with the attaching surface 308 of the attaching member 31B.

[0025]

Thereafter, when the attaching member 31B is moved to the rear end side (the arrow B direction in Fig. 6), the claws 310a to 310d of the attaching member 31B are engaged with the engagement portions 232a to 232d of the connecting plate 23 so that the attaching member 31B is undetachably attached to the connecting plate 23, and the key 311 is moved to a locking position by the pressure of the spring 312 to be fitted in the engagement portion 233, so that the attachment of the image sensing unit 3 to the connecting plate 23 is locked.

[0026]

To detach the image sensing unit 3 from the connecting plate 23, the unlocking lever 315 is operated in a direction away from the attaching surface 308 (the arrow C direction in Fig. 7) to move the key 311 to the unlocking position so that the key member 311 is disengaged from the engagement portion 233, and after the attaching member 31B is moved relatively to the connecting plate 23 in the direction opposite to the B direction under this condition, the attaching member 31B is moved in a direction of separation from the connecting plate 23.

[0027]

When the image sensing unit 3 is detached from or attached to the camera body 2, the unlocking lever 315 moves in the C direction and with this, a microswitch 316 is turned on, and this condition is detected by a subsequently-described general controller 211 in the camera body 2.

[0028]

As the above-described image sensing unit 3 with a 1/2-inch CCD, in addition to a standard zoom lens unit with an actual focal length of 7 to 21 mm (approximately 38 to 115 mm in terms of 35-mm film) and F numbers of 3.6 (wide-angle side) to 5.6 (telephoto side), a wide-angle lens unit using a wide-angle lens element with an actual focal length of 5.2 mm (approximately 28 mm in terms of 35-mm film) and an F number of 1.9 can be attached.

[0029]

While a structure in a case where the image sensing unit 3 is directly attached to the camera body 2 has been explained in the above description, the image sensing unit 3 can be connected to the camera body 2 through a specifically designed extension cable 32. Fig. 8 shows the appearance of the extension cable 32. In the extension cable, a connecting plate 1322 having the same structure as the connecting plate 23 is disposed at one end of a cable portion 1321 having a predetermined length, and a connecting portion 1323 having the same structure as the attaching member 31B of the image sensing unit 3 is disposed at the other end. When the image sensing unit 3 and the camera body 2 are connected through the extension cable 32, the connecting plate 1322 of the extension cable 32 is joined to the hole 309 of the attaching member 31B of the image sensing unit 3 and the connecting portion 1323 at the other end of the extension cable 32 is joined to the connecting plate 23 of the camera body 2.

[0030]

The connecting plate 1322 of the extension cable 32 is provided with a connecting terminal group 1334 having a plurality of terminals so as to be opposed to the connecting terminal group 234 in the hole 309 of the attaching member 31B of the image sensing unit 3, and in a hole 1309 of the connecting portion 1323, the plurality of connecting terminal group 1334 opposed to the connecting terminal group 234 on the attaching surface of the connecting plate 23 of the camera body 2 are disposed. When the image sensing unit 3 is attached to the camera body 2 through the extension cable 32, the image sensing unit 3 and the camera body 2 are electrically connected through the connecting terminal groups.

[0031]

The extension cable 32 includes two types; one is 1.5 meters in length and the other is 5 meters in length. The condition of connection between the camera body 2 and the image sensing unit 3, i.e., whether the image sensing unit 3 is connected through the extension cable 32 or not and the length of the extension cable 32 used, can be recognized based on a specific contact condition of a connecting terminal 234g described later.

[0032]

Subsequently, a system using the digital camera 1 will be described with reference to Fig. 9. For the camera body 2, not only the connection of an image sensing unit such as a standard zoom lens unit 3N or a wide-angle lens unit 3W and the connection of the image sensing unit through the extension cable 32 are possible, as described above, but also an accessory such as a personal computer interface 4 or a video capture adapter 5 can be connected directly to the camera body 2 instead of the image sensing unit. In this

embodiment, the mechanisms of connection and detachment of the image sensing unit and the interfaces 4 and 5 to and from the camera body 2 are all the same and the connecting terminals are compatible. In addition, a modem and an adapter for an external display can also be connected.

5 [0033]

With reference to Fig. 10, a case in which the image sensing unit 3 is connected to the camera body 2 will be described. First, the internal block of the image sensing unit 3 will be described. The CCD 303 photoelectrically converts an optical image of the subject formed by the macro zoom lens 301 into electrical image signals (signals comprising a string of pixel signals received by each photo receiving element of the CCD) of red (R), green (G) and blue (B) components, and outputs the image signals. A timing generator 331 generates various timing pulses for controlling the driving of the CCD 303.

[0034]

Since the diaphragm is fixed, exposure control in the image sensing unit 3 is performed by adjusting the exposure amount of the CCD 303, that is, the charge accumulation time of the CCD 303 corresponding to the shutter speed. When an appropriate shutter speed cannot be set at a low subject brightness, the levels of the image signals outputted from the CCD 303 are adjusted to thereby compensate for inappropriate exposure due to insufficient exposure. That is, when the brightness is low, exposure control is performed by combining the shutter speed and the gain adjustment. The image signal level adjustment is performed in gain adjustment of an AGC circuit in a signal processing circuit 313.

[0035]

A CCD drive circuit 314 generates a drive signal for the CCD 303 based on a signal transmitted from the timing generator 331. The timing generator 331 generates clock signals such as a timing signal for an A/D converter 321 and signals for controlling reading of light reception signals of pixels (a horizontal transfer signal and a vertical transfer signal).

[0036]

The signal processing circuit 313 performs a predetermined analog signal processing on the image signals as analog signals outputted from the CCD 303. The signal processing circuit 313 has a CDS (correlated double sampling) circuit and the AGC (automatic gain control) circuit, reduces noise of the image signals by the CDS circuit and adjusts the levels of the image signals by adjusting the gain of the AGC circuit.

[0037]

The light adjust circuit 304 controls the light emission amount of the built-in flash 13 in flash shooting so as to be a predetermined light emission amount set by the general controller 211. In flash shooting, the reflected flash light from the subject is received by the sensor 305 simultaneously with the start of exposure, and when the light reception amount reaches the predetermined light emission amount, the light adjust circuit 304 outputs a light emission stop signal. In response to the light emission stop signal, the general controller 211 forcefully stops the light emission of the built-in flash 13 by a flash control circuit 214, so that the light emission amount of the built-in flash 13 is controlled so as to be the predetermined light emission amount.

[0038]

The A/D converting circuit 321 converts the pixel signals as analog signals into 10-bit digital signals based on an A/D conversion clock inputted from the timing generator 331.

[0039]

In the image sensor 3, the AF sensor 306 for phase difference detection is disposed. Based on an output of the AF sensor 306, the taking lens 301 is driven by an AF motor control circuit and an AF motor 307 and the subject image is brought to in-focus state on the CCD 303.

[0040]

In an EEPROM 341, structural information of the image sensing unit 3 is stored as shown in Fig. 11. As described above, the image sensing unit 3 is replaceable with other units having different optical systems, CCDs and signal processing circuits. When the image sensing unit 3 is replaced, the general controller 211 obtains information of the image sensing unit from the EEPROM 341 and switches control based on the information.

[0041]

The above-described image sensing unit 3 and the subsequently-described camera body 2 are electrically connected by eight connecting terminal groups 334a, 334b, 334c, 334d, 334e, 334f, 334g and 334h provided in the connecting terminal groups 334 of the image sensing unit 3 and eight connecting terminal groups 234a, 234b, 234c, 234d, 234e, 234f, 234g and 234h provided on the connecting plate 233 of the camera body 2. Note that the terminal 234f is a bus for the personal computer interface 4 or the video capture adapter 5, and is not used when the image sensing unit 3 or the extension cable 32 is connected to the camera body 2.

[0042]

Subsequently, the internal block of the camera body 2 will be described. A case in

which a standard zoom lens 3N unit is attached as the image sensing unit 3 will be described as an example. A timing control circuit (not shown) for generating the reference clock and clocks for the timing generator 331 and the A/D converter 321 is disposed in the camera body 2. The timing control circuit is controlled by the general controller 211.

5 [0043]

A black level correcting circuit 205 corrects the black level of the A/D converted pixel signals (hereinafter, referred to as "pixel data") into a reference black level by use of a black reference signal. An interpolating circuit 206 generates, by interpolation, image data in which each pixel has 10-bit R, G and B components from raw image data outputted from the CCD 303.

10 [0044]

A WB (white balance) circuit 207 converts the levels of pixel data of the R, G and B components so that the white balance is also adjusted after gamma correction. The WB circuit 207 uses a level conversion table inputted from the general controller 211 to convert the levels of pixel data of the R, G and B components. The conversion coefficient, i.e. characteristic inclination, of each color component of the level conversion table is set for each shot image by the general controller 211.

15 [0045]

A gamma correcting circuit 208 corrects the gamma characteristic of the pixel data. The gamma correcting circuit 208 has six kinds of gamma correction tables with different gamma characteristics, and performs gamma correction of the pixel data based on a predetermined gamma correction table in accordance with the shooting scene and the shooting condition.

20 [0046]

An image memory 209 is for storing therein the pixel data outputted from the gamma correcting circuit 208. The image memory 209 has a storage capacity corresponding to one frame. That is, when the CCD 303 has $n \times m$ pixels, the image memory 209 has a storage capacity for pixel data corresponding to $n \times m$ pixels, and the pixel data are each stored in a corresponding pixel position.

25 [0047]

A VRAM 210 is a buffer memory for the image data reproduction-displayed on the LCD 10. The VRAM 210 has a storage capacity for the image data corresponding to the number of pixels of the LCD 10.

[0048]

In the shooting standby state, after predetermined signal processings are performed by the circuits 205 to 208 on the pixel data of images shot by the image sensing unit 3 every 1/30 second, the pixel data are stored in the image memory 209 and are transferred to the VRAM 210 through the general controller 211 so as to be displayed on the LCD 10. That is, liveview display is performed. Consequently, the user can visually confirm the subject image by the image displayed on the LCD 10.

[0049]

In the reproduction mode, after a predetermined signal processing is performed by the general controller 211 on the image read out from the memory card 8, the image is transferred to the VRAM 210 so as to be reproduction-displayed on the LCD 10. A card I/F 212 is an interface for writing image data onto the memory card 8 and reading image data from the memory card 8.

[0050]

The flash control circuit 214 controls light emission of the built-in flash 13. The flash control circuit 214 includes a flash charging circuit, controls the execution or no execution, the amount and the timing of light emission of the built-in flash 13 based on a control signal from the general controller 211, and controls the light emission amount of the built-in flash 13 based on the light emission stop signal inputted from the light adjust circuit 304.

[0051]

An RTC 219 is a clock circuit for managing the shooting date and time, and is driven by a non-illustrated different power source.

[0052]

An operation portion 250 includes the above-described UP switch 6, DOWN switch 7, erasing switch D, shutter button 9, FL mode setting switch 11, compression rate setting switch 12, shooting/reproduction mode setting switch 14 and power switch PS.

[0053]

A power circuit E comprises four batteries and a power source portion for converting supply voltage for supplying necessary power from the power source to each circuit, and supplies power to the circuits in the camera body 2 and to the circuits in the image sensing unit 3 or an accessory connected to the camera body 2 through the connecting terminals 234h and 334h. By connecting an AC adapter to the camera body 2, commercial AC power can be used as the power source instead of batteries.

[0054]

The general controller 211 comprises a microcomputer, and performs centralized control of the shooting operation of the digital camera 1 by organically controlling the driving of the members in the image sensing unit 3 and the camera body 2.

5 [0055]

The general controller 211 has a brightness determining portion for setting the exposure control value, i.e. shutter speed (SS), and a shutter speed setting portion. The brightness determining portion determines the brightness of the subject by use of the images captured by the CCD 303 every 1/30 second in the shooting standby state. That is, the
10 brightness determining portion determines the brightness of the subject by use of the image data renewedly stored in the image memory 209. The brightness determining portion divides the storage area of the image memory 209 into nine blocks, and calculates the brightness data representing each block by use of the pixel data of the G (green) component included in each block.

15 [0056]

The shutter speed setting portion sets the shutter speed, i.e. the integration period of time of the CCD 303, based on the result of the subject brightness determination by the brightness determining portion. The shutter speed setting portion has a table of the shutter speed SS.

20 [0057]

The shutter speed SS is reset to 1/128 second when the camera is activated. In the shooting standby state, the shutter speed setting portion changes the shutter speed from the initial value to the high speed side or to the low speed side in steps in accordance with the result of the subject brightness determination by the brightness determining portion.

25 [0058]

The general controller 211 has a filter portion for performing filtering processing and a recorded image forming portion for forming thumbnail images and compressed images to perform the above-described shot image recording processing, and has a reproduced image forming portion for forming reproduced images to reproduce images recorded on the memory
30 card 8 on the LCD 10.

[0059]

The filter portion corrects, by a digital filter, a high-frequency component of an image to be recorded to thereby correct the image quality associated with the contour. The filter

portion has the following five kinds of digital filters for each of the compression rates K of 1/8 and 1/20: a digital filter for performing a normal contour correction; and two kinds of digital filters for enhancing the contour and two kinds of digital filters for weakening the contour with respect to the normal contour correction.

5 [0060]

The recorded image forming portion reads out pixel data from the image memory 209 and forms thumbnail images and compressed images to be recorded onto the memory card 8. The recorded image forming portion reads out pixel data from the image memory 209 every eight pixels both in the horizontal and the vertical directions while performing scanning in a raster scanning direction, and successively transfers the pixel data to the memory card 8, thereby recording the thumbnail images onto the memory card 8 while forming them.

[0061]

Moreover, the recorded image forming portion reads out all the pixel data from the image memory 209 and performs predetermined JPEG compression processings such as two-dimensional discrete cosine transformation and Haffman coding on the pixel data to generate image data of the compressed image, and records the compressed image data into a regular image area of the memory card 8.

[0062]

When an instruction to perform shooting is given by the shutter button 9 in the shooting mode, the general controller 211 forms a thumbnail image and a compressed image, JPEG-compressed at the compression rate K set by the compression rate setting switch 12, of the image captured into the image memory 209 after the instruction is given, and records these images onto the memory card 8 together with tag information on the shot image (information such as frame number, exposure value, shutter speed, compression rate K, shooting date, ON or OFF of the flash at the time of shooting, scene information, and the result of image determination).

[0063]

With respect to the images recorded by the digital camera 1, 40 frames of images can be stored when the compression rate is 1/20. As shown in Fig. 12, a tag portion 81, JPEG-compressed high-resolution image data (640 × 480 pixels) 82 and image data (80 × 60 pixels) 83 for thumbnail display are recorded in each frame. Each frame can be treated as an EXIF-format image file.

[0064]

When the shooting/reproduction mode setting switch 14 is set to the reproduction mode, the image data with the highest frame number in the memory card 8 is read out, decompressed by the reproduced image forming portion and transferred to the VRAM 210, whereby the image with the highest frame number, that is, the most recently shot image is displayed on the display 10. By operating the UP switch 6, an image with a higher frame number is displayed. By depressing the DOWN switch 7, an image with a lower frame number is displayed.

[0065]

Subsequently, the structure of the power circuit E in the camera body 2 will be described with reference to Fig. 13. Driving power is supplied from the four batteries E1 to E4 to all the circuit blocks (including the general controller 211) in the camera body 2 by a body control system power source portion E100. The body control system power source portion E100 drives also the signal processing circuit 313, the A/D converter 321 and the EEPROM 341 in the image sensing unit 3. The activation and deactivation of the body control system power source portion E100 is switched by operating the power switch PS.

[0066]

To an AF motor system power source portion E110, an AF sensor and timing generator system power source portion E120, a CCD and CCD drive circuit system power source portion E130, a personal computer interface system power source portion E140 and a video capture adapter system power source portion E150, power is supplied from the main control system power source portion E100. Power supply to the power source portions other than the body control system power source portion E100 is controlled by the general controller 211 as described later. In each power source portion, by converting the voltage of the body control system power source portion E100, a voltage the most suitable for each circuit block in the image sensing unit 3 and accessories is generated. By using an AC adapter E200, a commercial AC power source E300 can be used as a power source, as well as the batteries E1 to E4.

[0067]

The body control system power source portion E100 is for supplying power to all the circuit blocks in the camera body 2 and to the signal processing circuit 313, the A/D converter 321 and the EEPROM 341 in the image sensing unit 3. The AF motor system power source portion E110, the AF sensor and timing generator system power source portion E120 and the CCD and CCD drive circuit system power source portion E130 are for supplying power to the

AF motor and the motor control circuit 307, the AF sensor 306 and the timing generator 331 and the CCD 303 and the CCD drive circuit 314 in the image sensing unit 3, respectively. The personal computer interface system power source portion E140 is for supplying power to circuit blocks in the personal computer interface 4. The video capture adapter system power source portion E150 is for supplying power to circuit blocks in the video capture adapter 5. The power source portions supply power to the image sensing unit 3 or an accessory connected to the camera body 2 through terminals 234h1, 234h2, 234h3, 234h4, 234h5 and 234h6 of the connecting terminal group 234h.

[0068]

Fig. 14 is a block diagram in a case where the personal computer interface 4 is connected to the camera body 2 instead of the image sensing unit 3. In this case, the black level correcting circuit 205, the interpolating circuit 206, the WB circuit 207, the gamma correcting circuit 208, the built-in flash 13 and the flash control circuit 214 in the camera body 2 are deactivated, the shooting/reproduction mode setting switch 14 is disabled, and the digital camera 1 is always in the reproduction mode. The image memory 209 is used as a work area for processing.

[0069]

When the personal computer interface 4 is connected, in response to an instruction from a personal computer 40, the shot image data read out from the memory card 8 are captured by the personal computer 40 through the card I/F 212, a reproduced image generating portion in the general controller 211, the connecting terminals 234f and 434f, an interface circuit 41 and a personal computer connecting terminal 42 under the control by the general controller 211. For the interface circuit 41, a known RS-232C or USB interface is usable. Power for driving the personal computer interface 4 is supplied from the personal computer interface system power source portion E140 in the power source portion of the camera body 2.

[0070]

Fig. 15 is a block diagram in a case where the video capture adapter 5 is connected to the camera body 2 instead of the image sensing unit 3. In this case, the black level correcting circuit 205, the interpolating circuit 206, the WB circuit 207, the gamma correcting circuit 208, the built-in flash 13 and the flash control circuit 214 in the camera body 2 are deactivated, the shooting/reproduction mode setting switch 14 is disabled, and the digital camera 1 is always in the reproduction mode. The image memory 209 is used as a work area for processing.

Power for driving the video capture adapter 5 is supplied from the video capture adapter system power source portion E150 in the power source portion of the camera body 2.

[0071]

When the video capture adapter 5 is connected, after a video signal (e.g. an NTSC video signal outputted from a television tuner) inputted through a video input terminal 52 is digitized by a video capture circuit 51 in response to an operation instruction by an operation portion 53 of the video capture adapter 5, the video signal is processed by the general controller 211 at intervals of 1/30 second through the terminals 534f and 234f, so that the image data is developed on the VRAM 210. Consequently, the inputted video signal is displayed on the LCD 10. The operation portion 53 includes a capture button comprising a push button, and the image data at the instant of pushing the button is recorded onto the memory card 8.

[0072]

By connecting the video capture adapter 5 to the digital camera 1, television signals and images shot by a different camera such as a video camera can easily be digitized and recorded, so that the convenience of the digital camera is increased. Moreover, since both images shot by a digital camera 1 and images shot by a video camera can be stored in one memory card 8, the image data in the memory card 8 can effectively be edited.

[0073]

Subsequently, a method of identifying the connection device connected to the camera body 2 will be described. Four terminals 234g1, 234g2, 234g3 and 234g4 of the connecting terminal group 234g of the camera body 2 serve as detection terminals. The general controller 211 detects the voltage level of the terminal 234g1, whether there is continuity between the terminals 234g2 and 234g3 or not and whether there is continuity between the terminals 234g2 and 234g4 or not to thereby detect seven conditions.

[0074]

In the camera body 2, of the wiring between the connecting terminal group 234g and the general controller 211, the wiring with the connecting terminal 234g1, the wiring with the connecting terminal 234g3 and the wiring with the connecting terminal 234g4 are pulled up and the wiring with terminal 234g2 is not pulled up.

[0075]

The image sensing unit 3 has four terminals 334g1, 334g2, 334g3 and 334g4 connecting with the four terminals 234g1, 234g2, 234g3 and 234g4 of the connecting terminal

group 234g of the camera body 2, respectively. In the image sensing unit 3, the terminal 334g1 is grounded, and the other three terminals 334g2, 334g3 and 334g4 are not connected anywhere. The connection condition of the terminals in a case where the image sensing unit 3 is connected to the camera body 2 is shown in Fig. 16.

[0076]

The 1.5 meters extension cable 32-1 has four terminals 1334g11, 1334g12, 1334g13 and 1334g14 connecting with the four terminals 234g1, 234g2, 234g3 and 234g4 of the connecting terminal group 234g of the camera body 2, respectively, and four terminals 1334g15, 1334g16, 1334g17 and 1334g18 connecting with the four terminals 334g1, 334g2, 334g3 and 334g4 of the image sensing unit 3, respectively. In the 1.5 meters extension cable 32-1, the terminal 1334g11 and the terminal 1334g15 are connected together, the terminal 1334g12 and the terminal 1334g13 are connected together, and the other terminals 1334g14, 1334g16, 1334g17 and 1334g18 are not connected anywhere. The connection condition of the terminals in a case where the image sensing unit 3 is connected to the camera body 2 through the 1.5 meters extension cable 32-1 is shown in Fig. 17.

[0077]

The 5 meters extension cable 32-2 has four terminals 1334g21, 1334g22, 1334g23 and 1334g24 connecting with the four terminals 234g1, 234g2, 234g3 and 234g4 of the connecting terminal group 234g of the camera body 2, respectively, and four terminals 1334g25, 1334g26, 1334g27 and 1334g28 connecting with the four terminals 334g1, 334g2, 334g3 and 334g4 of the image sensing unit 3, respectively. In the 5 meters extension cable 32-2, the terminals 1334g21 and the terminal 1334g25 are connected together, the terminal 1334g22, the terminal 1334g23 and the terminal 1334g24 are connected together, and the other terminals 1334g26, 1334g27 and 1334g28 are not connected anywhere. The connection condition of the terminals in a case when the image sensing unit 3 is connected to the camera body 2 through the 5 meters extension cable 32-2 is shown in Fig. 18.

[0078]

The personal computer interface 4 has four terminals 434g1, 434g2, 434g3 and 434g4 connecting with the four terminals 234g1, 234g2, 234g3 and 234g4 of the connecting terminal group 234g of the camera body 2, respectively. In the personal computer interface 4, the terminal 434g1 is grounded, the terminal 434g2 and the terminal 434g4 are connected together, and the other terminal 434g3 is not connected anywhere. The connection condition of the terminals in a case where the personal computer interface 4 is connected to the camera body 2

is shown in Fig. 19.

[0079]

The video capture adapter 5 has four terminals 534g1, 534g2, 534g3 and 534g4 connecting with the four terminals 234g1, 234g2, 234g3 and 234g4 of the connecting terminal group 234g of the camera body 2, respectively. In the video capture adapter 5, the terminal 534g2 and the terminal 534g4 are connected together, and the other terminals 534g1 and 534g3 are not connected anywhere. The connection condition of the terminals in a case where the video capture adapter 5 is connected to the camera body 2 is shown in Fig. 20.

[0080]

According to the above-mentioned structure, the relationship between the condition of connection of connection devices to the camera body 2, and the voltage level of the terminal 234g1, whether there is continuity between the terminal 234g2 and the terminal 234g3 or not and whether there is continuity between the terminal 234g2 and the terminal 234g4 or not is as shown in Fig. 21, and the general controller 211 can recognize the condition of connection of connection devices to the camera body 2.

[0081]

Hereinafter, control performed by the general controller 211 will be described with reference to the flowchart shown in Fig. 22. When the body control system power source portion E100 is activated by operating the power switch PS and power supply is started, first, the voltage level of the terminal 234g1, whether there is continuity between the terminal 234g2 and the terminal 234g3 or not and whether there is continuity between the terminal 234g2 and the terminal 234g4 or not, that is, information on connection of the connection device to the camera body 2 is obtained (step #10). Then, the condition of connection of the connection device to the camera body 2 is recognized based on the information obtained at #10 (#20).

[0082]

When it is recognized at #20 that the personal computer interface 4 is connected to the camera body 2 as the connection device, power is supplied to the personal computer interface system power source portion E140 and no power is supplied to the flash control circuit 214, the AF motor system power source portion E110, the AF sensor and timing generator system power source portion E120, the CCD and CCD drive circuit system power source portion E130 and the video capture adapter system power source portion E150 (#30). Then, the process shifts to a subroutine (#40) to perform processing such as image data transfer necessary when the personal computer interface 4 is connected.

[0083]

When it is recognized at #20 that the video capture adapter 5 is connected to the camera body 2, power is supplied to the video capture adapter system power source portion E150 and no power is supplied to the flash control circuit 214, the AF motor system power source portion E110, the AF sensor and timing generator system power source portion E120, the CCD and CCD drive circuit system power source portion E130 and the personal computer interface system power source portion E140 (#50). Then, the process shifts to a subroutine (#60) to perform processing such as video signal capture necessary when the video capture adapter 5 is connected.

[0084]

When it is recognized at #20 that the image sensing unit 3 is connected to the camera body 2 through the extension cable 32, the type of the extension cable 32 is determined (#65). When it is recognized that the length of the extension cable 32 is 5 m, power is supplied to the AF motor system power source portion E110, the AF sensor and timing generator system power source portion E120 and the CCD and CCD drive circuit system power source portion E130 and no power is supplied to the flash control circuit 214, the personal computer interface system power source portion E140 and the video capture adapter system power source portion E150 (#70). Then, the process shifts to a subroutine (#90) to perform digital camera processing in the shooting mode and the reproduction mode in a condition where the image sensing unit 3 is connected.

[0085]

When it is recognized that the length of the extension cable 32 is 1.5 meters, power is supplied to the flash control circuit 214, the AF motor system power source portion E110, the AF sensor and timing generator system power source portion E120 and the CCD and CCD drive circuit system power source portion E130 and no power is supplied to the personal computer interface system power source portion E140 and the video capture adapter system power source portion E150 (#80). Then, the process shifts to #90.

[0086]

When it is recognized at #20 that the image sensing unit 3 is connected to the camera body 2 directly (not through the extension cable 32), the process shifts to S70 like in the case where it is recognized that the image sensing unit 3 is connected to the camera body 2 through the 1.5 meters extension cable 32.

[0087]

When it is recognized at #20 that nothing is connected to the camera body 2 or that although the extension cable 32 is connected, the image sensing unit 3 is not connected to the extension cable 32, no power is supplied to the flash control circuit 214, the AF motor system power source portion E110, the AF sensor and timing generator system power source portion E120, the CCD and CCD drive circuit system power source portion E130, the personal computer interface system power source portion E140 and the video capture adapter system power source portion E140 (#100). Then, the process shifts to a subroutine (#110) to perform processing necessary in the reproduction mode.

[0088]

By the above-described control, for example, to the flash control circuit 214, no power is supplied when the personal computer interface 4 or the video capture adapter 5 is connected to the camera body 2, when the image sensing unit 3 is connected to the camera body 2 through the 5 meters extension cable 32, when nothing is connected to the camera body 2 and when the image sensing unit 3 is not connected to the extension cable 32 although the extension cable 32 is connected to the camera body 2. This is because in the above-mentioned conditions of connection of the connection devices to the camera body 2, the built-in flash 13 cannot function and it is therefore unnecessary to drive the flash control circuit 214.

[0089]

No power is supplied to the flash control circuit 214 when the image sensing unit 3 is connected to the camera body 2 through the 5 meters extension cable 32. This is because the light projection distance of the built-in flash 13 is approximately 4 m and when the image sensing unit 3 is connected through the 5 meters extension cable 32, flash light does not reach and the possibility is high that the built-in flash 13 cannot function. In this case, when the flash shooting mode is selected by the FL mode setting switch 11, warning may be provided, or the flash shooting mode may be unselectable.

[0090]

To the AF motor system power source portion E110, the AF sensor and timing generator system power source portion E120 and the CCD and CCD drive circuit system power source portion E130, no power is supplied when the personal computer interface 4 or the video capture adapter 5 is connected to the camera body 2, when nothing is connected to the camera body 2 and when the image sensing unit 3 is not connected to the extension cable 32 although the extension cable 32 is connected to the camera body 2, that is, except when the image sensing unit 3 is connected to the camera body 3 directly or through the extension cable

32. This is because these power source portions are for supplying power to the circuit blocks in the image sensing unit 3 and it is therefore unnecessary to drive them in these cases.

[0091]

To the personal computer interface system power source portion E140, no power is supplied except when the personal computer interface 4 is connected to the camera body 2. This is because the power source portion E140 is for supplying power to the circuits in the personal computer interface 4 and it is therefore unnecessary to drive the personal computer interface except when the personal computer interface 4 is connected.

[0092]

To the video capture adapter system power source portion E150, no power is supplied except when the video capture adapter 5 is connected to the camera body 2. This is because the power source portion E150 is for supplying power to the circuits in the video capture adapter 5 and it is therefore unnecessary to drive the video capture adapter except when the video capture adapter 5 is connected.

[0093]

As described above, in the digital camera 1 of this embodiment, since no power is supplied to circuits that it is unnecessary to drive by controlling power supply to circuits associated with connection devices, specifically, the flash control circuit 214, the AF motor system power source portion E110, the AF sensor and timing generator system power source portion E120, the CCD and CCD drive circuit system power source portion E130, the personal computer interface system power source portion E140 and the video capture adapter system power source portion E150, unnecessary power consumption is restrained, so that power consumption is reduced.

[0094]

After steps #40, #60, #90 and #110, the following steps are provided: steps #120, #130, #140 and #150 where ON condition of the microswitch 316 is detected which condition is caused when the user detaches the image sensing unit 3 or an accessory from the camera body 2 by operating the unlocking lever 315 or when the user attaches the image sensing unit 3 or an accessory to the camera body 2; and steps #160, #170, #180 and #190 where the process returns to steps #40, #60, #90 and #110 when the microswitch 316 is not ON as a result of the detection at steps #120, #130, #140 and #150 and shifts to #10 when the microswitch 316 is ON.

[0095]

With this, the condition of connection of the connection device to the camera body 2 is recognized every time the connection device connected to the camera body 2 is changed and the power supply condition is switched in accordance with the connection device after the change, so that even when the connection device is changed, unnecessary power consumption is restrained and low-power-consumption state can be maintained.

[0096]

When detachment of the image sensing unit 3 or an accessory from the camera body 2 is detected, power supply to the body control system power source portion E100 may be stopped to deactivate the entire digital camera 1.

[0097]

When the digital camera 1 is provided with a function of emitting auxiliary light in automatic focusing, power supply to the circuit blocks involved only in the emission of the AF auxiliary light may be stopped when the personal computer interface 4 or the video capture adapter 5 is connected to the camera body 2 and when neither the image sensing unit 3 nor an accessory is connected to the camera body 2 or when the image sensing unit 3 is not connected to the extension cable 32 although the extension cable 32 is connected to the camera body 2. This is because the digital camera 1 cannot enter the shooting mode and does not perform automatic focusing in such cases.

[0098]

In a case where an auxiliary light emitter is provided on the side of the camera body 2, power supply to the circuit blocks involved only in the emission of the AF auxiliary light may be stopped when the image sensing unit 3 is connected to the camera body 2 through the extension cable 32. This is because the subject surface and the auxiliary light emitting surface are not likely to face each other at the time of shooting and the possibility is high that the emission of the AF auxiliary light is meaningless in such a case. By doing this, unnecessary power consumption can further be restrained and reduction in power consumption can be promoted.

[0099]

While the flash is incorporated in the camera body 2 in the digital camera 1 of the above-described embodiment, the flash may be of a type that is connected to the camera body 2. Moreover, while the unlocking lever 315 and the microswitch 316 are provided on the image sensing unit 3 and accessories, they may be provided on the camera body 2. Further, accessories may be connected through the extension cable 32.

[0100]

[Advantages of the Invention]

As described above, according to the present invention, a digital camera is so designed that, according to what connectable device is actually connected to the camera body, the feeding of electric power to the circuits relevant to the connectable device is controlled. Thus, electric power is no longer fed to circuits that do not need to be driven. This makes it possible to reduce unnecessary consumption of electric power, and thereby to reduce the overall power consumption.

[Brief Description of the Drawings]

[Fig. 1]

A front view of the appearance of a digital camera according to an embodiment of the present invention.

[Fig. 2]

A back view of the appearance of the digital camera according to the embodiment of the present invention.

[Fig. 3]

A bottom view of the appearance of the digital camera according to the embodiment of the present invention.

[Fig. 4]

A view showing the appearance and the internal structure of an image sensing unit.

[Fig. 5]

A perspective view of the appearance of the digital camera, in a condition where no connection device is connected to the camera body, according to the embodiment of the present invention.

[Fig. 6]

A view showing the structure of a connection portion between the camera body and the image sensing unit.

[Fig. 7]

A view of assistance in explaining a mechanism of attachment and detachment between the camera body and the image sensing unit.

[Fig. 8]

A diagram showing the appearance of an extension cable.

[Fig. 9]

A view showing a system using the digital camera.

[Fig. 10]

A block diagram showing the structure where the image sensing unit is connected to
5 the camera body.

[Fig. 11]

A view showing information stored in an EEPROM.

[Fig. 12]

A diagram showing data arrangement in a memory card.

10 [Fig. 13]

A block diagram showing the structure of power source portions.

[Fig. 14]

A block diagram showing the structure where a personal computer interface is
connected to the camera body.

15 [Fig. 15]

A block diagram showing the structure where a video capture adapter is connected to
the camera body.

[Fig. 16]

A diagram showing condition in a case where the image sensing unit is connected to
20 the camera body.

[Fig. 17]

A diagram showing condition where the image sensing unit is connected to the camera
body through a 1.5-m extension cable.

[Fig. 18]

25 A diagram showing condition where the image sensing unit is connected to the camera
body through a 5-m extension cable.

[Fig. 19]

A diagram showing condition where the personal computer interface is connected to
the camera body.

30 [Fig. 20]

A diagram showing condition where the video capture adapter is connected to the
camera body.

[Fig. 21]

A diagram showing a relationship between the condition of connection of connection devices to the camera body, and the voltage levels of terminals and continuity between terminals.

[Fig. 22]

5 A flowchart showing control performed by a general controller.

[Description of the Reference Designations]

	1	digital camera
	2	camera body
10	3	image sensing unit
	3N	standard zoom lens unit
	3W	wide-angle lens unit
	4	personal computer interface
	5	video capture adapter
15	6	frame feed switch (UP switch)
	7	frame feed switch (DOWN switch)
	8	memory card
	9	shutter button
	10	LCD
20	11	FL mode setting switch
	12	compression rate setting switch
	13	built-in flash
	14	shooting/reproduction mode setting switch
	15	lid
25	16	card chamber
	17	battery chamber
	23	connecting plate
	31A	image sensing unit main body
	31B	attaching member
30	32	extension cable
	32-1	1.5-meter extension cable
	32-2	5-meter extension cable
	40	personal computer

	41	interface circuit	
	42	personal computer connecting terminal	
	51	video capture circuit	
	52	video input terminal	
5	53	operation portion	
	205	black level correcting circuit	
	206	interpolating circuit	
	207	WB circuit	
	208	gamma correcting circuit	
10	209	image memory	
	210	VRAM	
	211	general controller	
	212	card I/F	
	214	flash control circuit	
15	219	RTC (clock circuit)	
	231a, 231b	concave portions	
	232a, 232b, 232c, 232d	engagement portions	
	233	engagement portion	
	234	connecting terminal group (camera body side)	
20	234a, 234b, 234c, 234d, 234e, 234f, 234g, 234h	connecting terminal group	
	250	operation portion	
	301	standard macro zoom lens	
	302	image sensing circuit	
	303	CCD	
25	304	light adjust circuit	
	305	light adjust sensor	
	306	AF sensor	
	307	AF motor	
	308	attaching surface	
30	309	hole	
	310a, 310b, 310c, 310d	engagement claws	
	311	key	
	312	spring	

	313	signal processing circuit
	314	CCD drive circuit
	315	unlocking lever
	316	microswitch
5	321	A/D converter
	331	timing generator
	334	connecting terminal group (image sensing unit side)
	341	EEPROM
	1231a, 1231b	concave portions
10	1232a, 1232b, 1232c, 1232d	engagement portions
	1233	engagement portion
	1309	hole
	1310a, 1310b, 1310c, 1310d	engagement claws
	1311	key
15	1315	unlocking lever
	1321	cable portion
	1322	connecting plate
	1323	connecting portion
	1334	connecting terminal group
20	D	erasing switch
	E	power circuit
	E1 to E4	batteries
	E100	body control system power source portion
	E110	AF motor system power source portion
25	E120	AF sensor and timing generator system power source portion
	E130	CCD and CCD drive circuit system power source portion
	E140	personal computer interface system power source portion
	E150	video capture adapter system power source portion
	PS	power switch
30		

[Title of the Document]

Drawings

FIG. 1

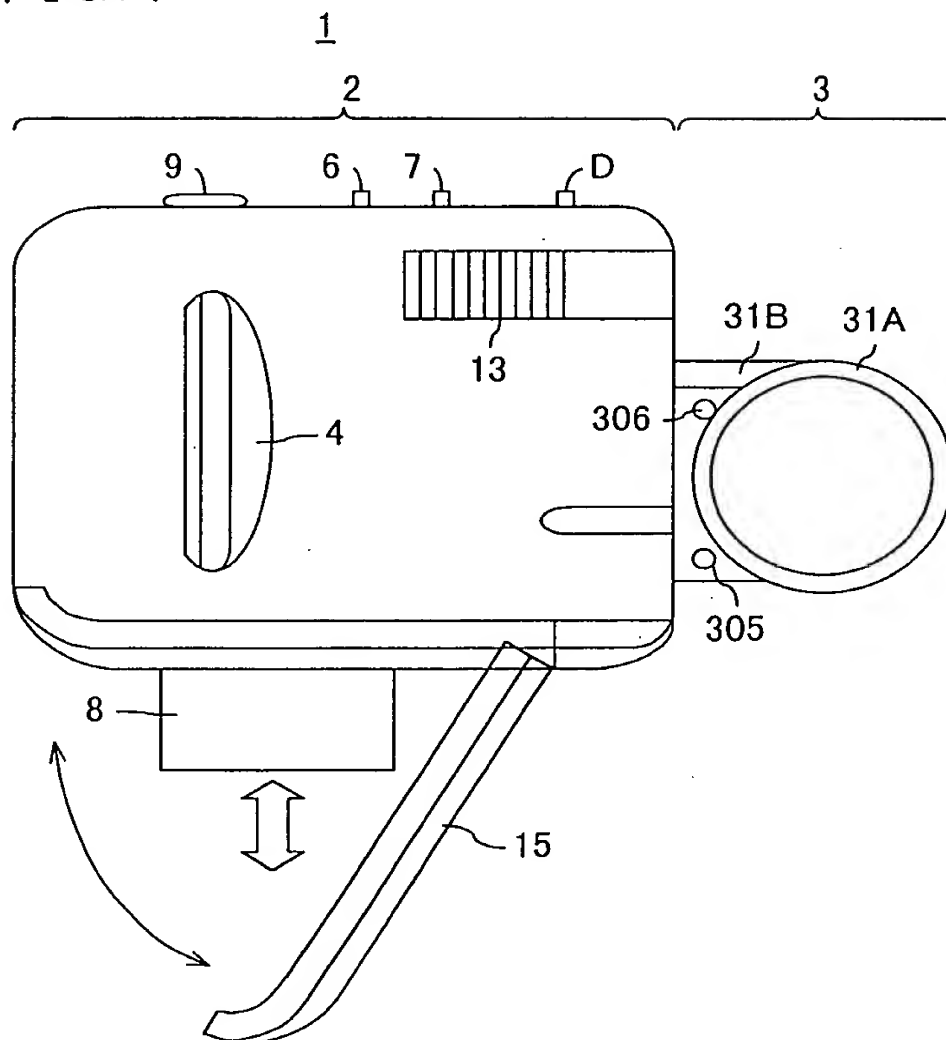




FIG.2

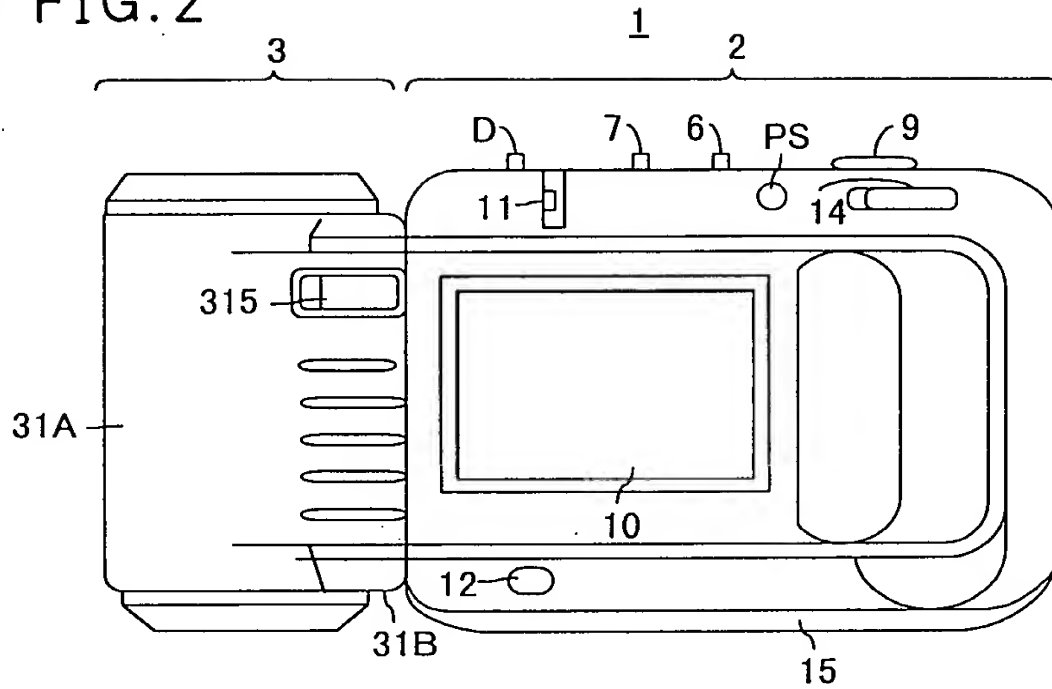


FIG.3

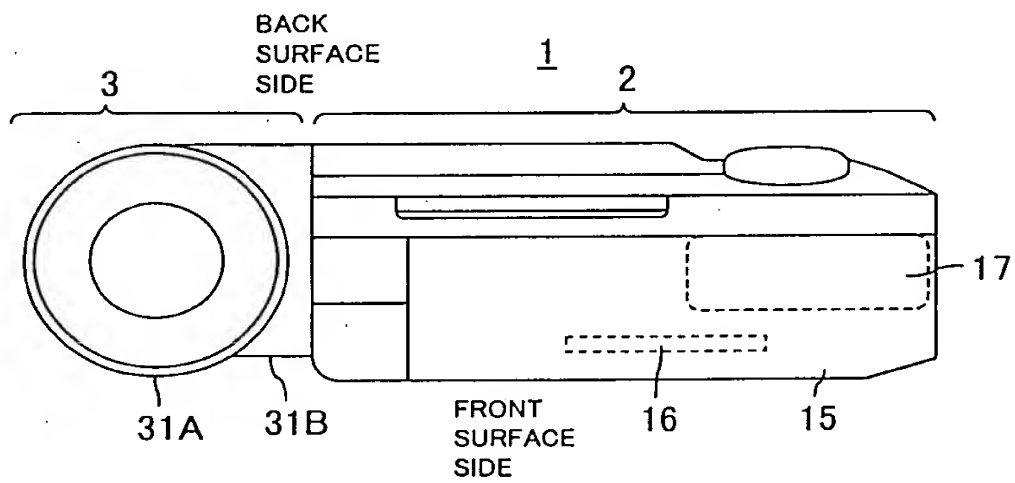


FIG.4

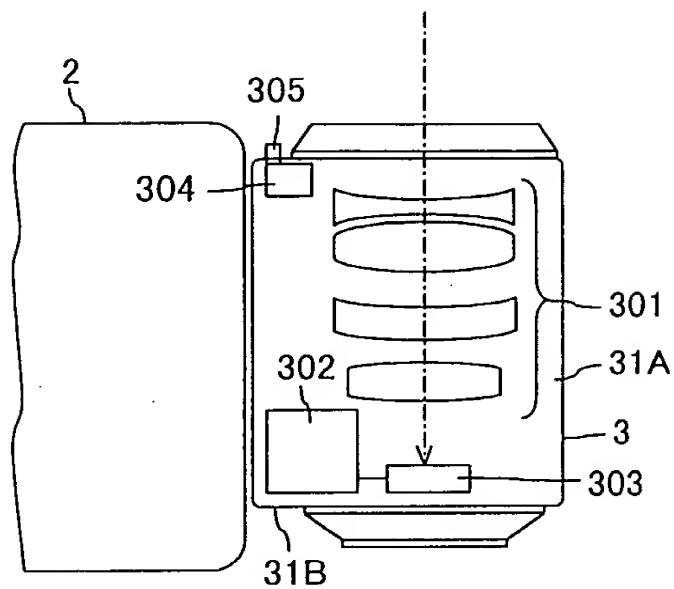




FIG.5

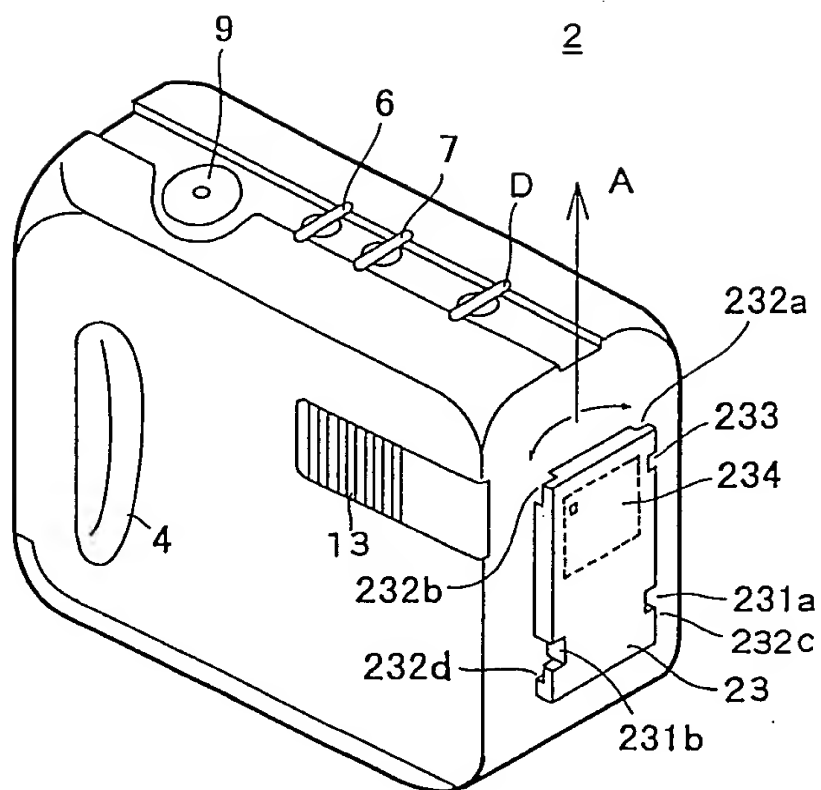


FIG. 6

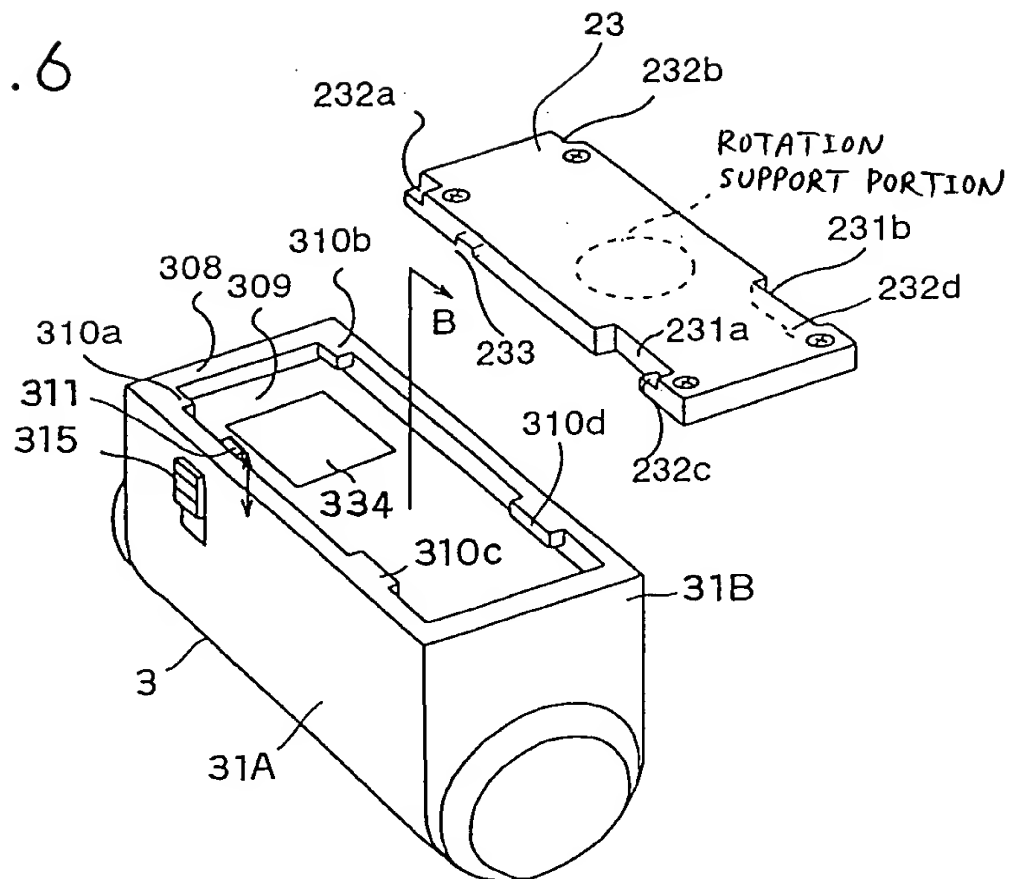
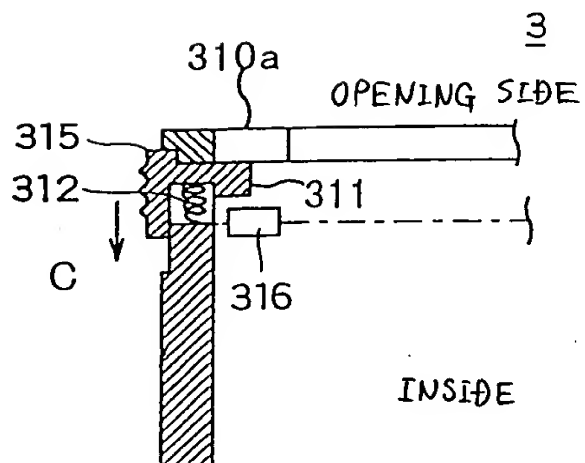


FIG. 7



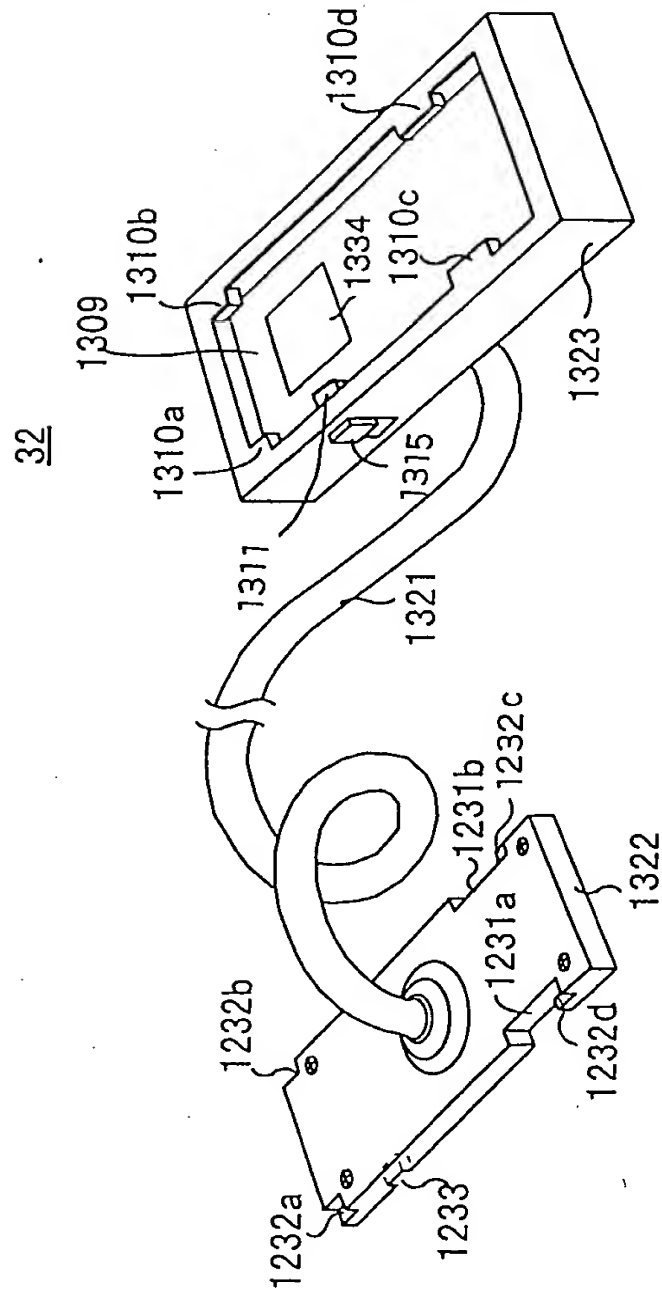


FIG. 8.

FIG. 9

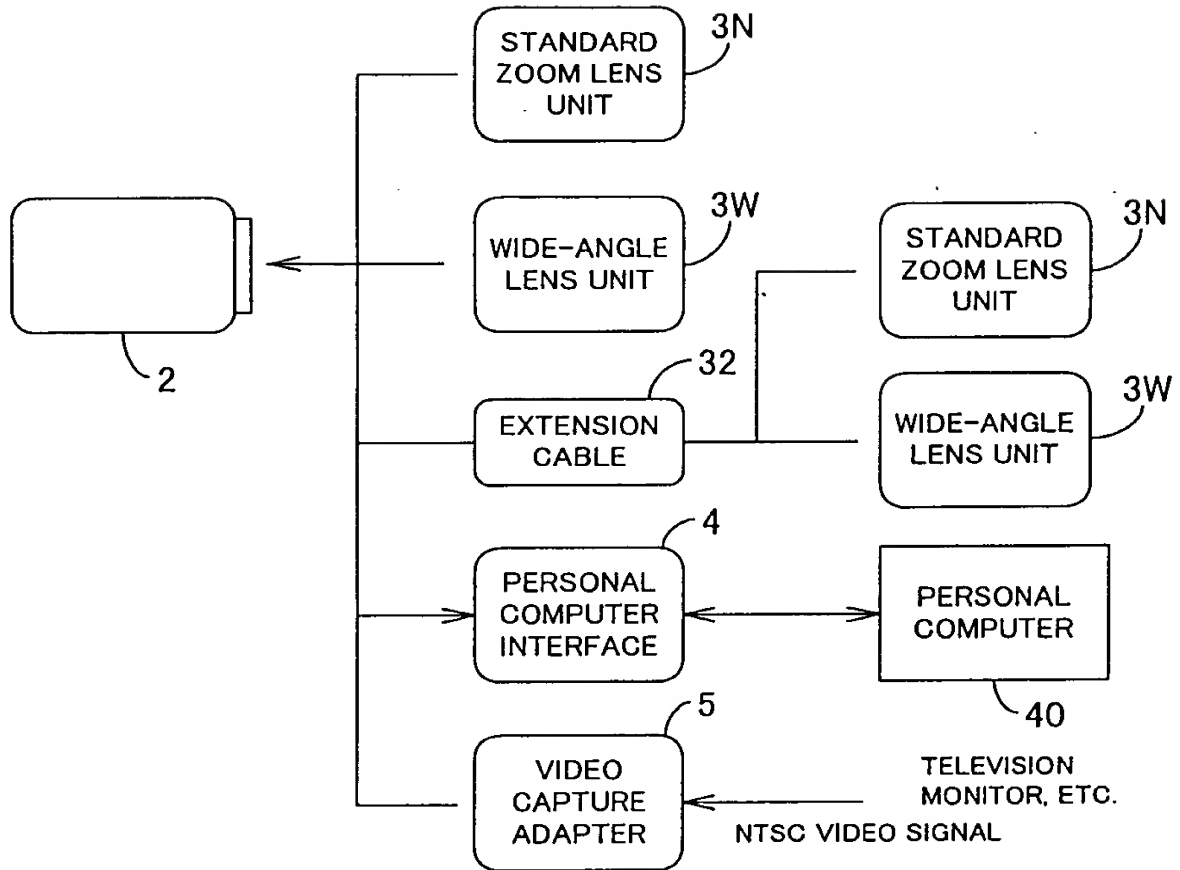


FIG.10

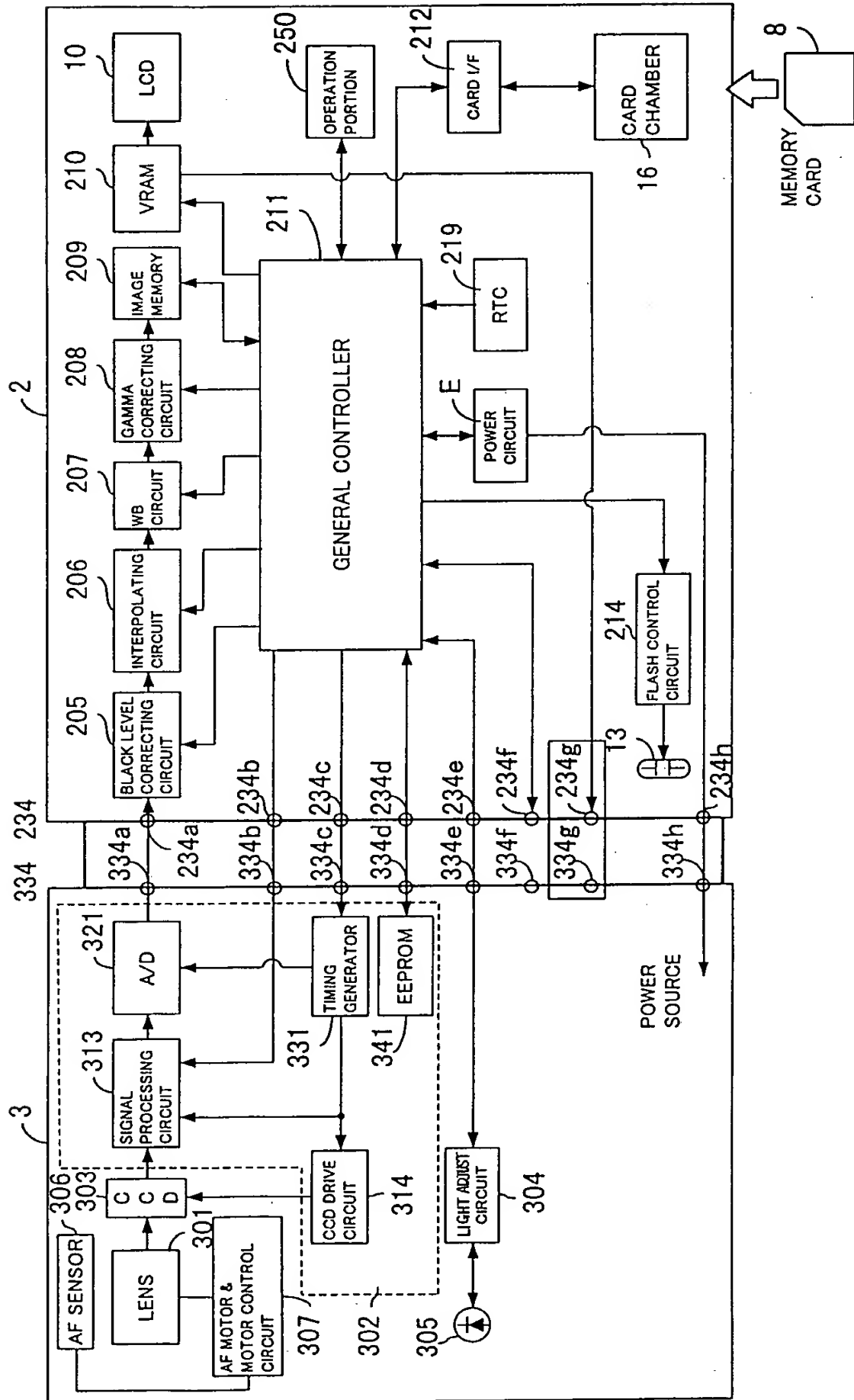


FIG.11

ADDRESS	EXPLANATION OF DATA
00	IMAGE SENSING UNIT OR INTERFACE TYPE
01	FILTER TYPE
02	DEFECTIVE PIXEL INFORMATION
03	NUMBER OF EFFECTIVE PIXELS (H)
04	NUMBER OF EFFECTIVE PIXELS (V)
05	EFFECTIVE PIXEL START POSITION (H)
06	EFFECTIVE PIXEL START POSITION (V)
07	NUMBER OF BLACK REFERENCE PIXELS (H)
08	NUMBER OF BLACK REFERENCE PIXELS (V)
09	BLACK REFERENCE PIXEL START POSITION (H)
0A	BLACK REFERENCE PIXEL START POSITION (V)
0B	HORIZONTAL SYNCHRONIZING SIGNAL PERIOD
0C	VERTICAL SYNCHRONIZING SIGNAL PERIOD
0D	WHITE BALANCE CORRECTION (R)
0E	WHITE BALANCE CORRECTION (B)
0F	IMAGE SENSING DEVICE SIZE
10	LENS F NUMBER (LONGEST FOCAL LENGTH CONDITION)
11	LENS FOCAL LENGTH (LONGEST FOCAL LENGTH CONDITION)
12	LENS FOCAL LENGTH IN TERMS OF 35 mm (LONGEST FOCAL LENGTH CONDITION)
13	LENS F NUMBER (SHORTEST FOCAL LENGTH CONDITION)
14	LENS FOCAL LENGTH (SHORTEST FOCAL LENGTH CONDITION)
15	LENS FOCAL LENGTH IN TERMS OF 35 mm (SHORTEST FOCAL LENGTH CONDITION)

FIG.12

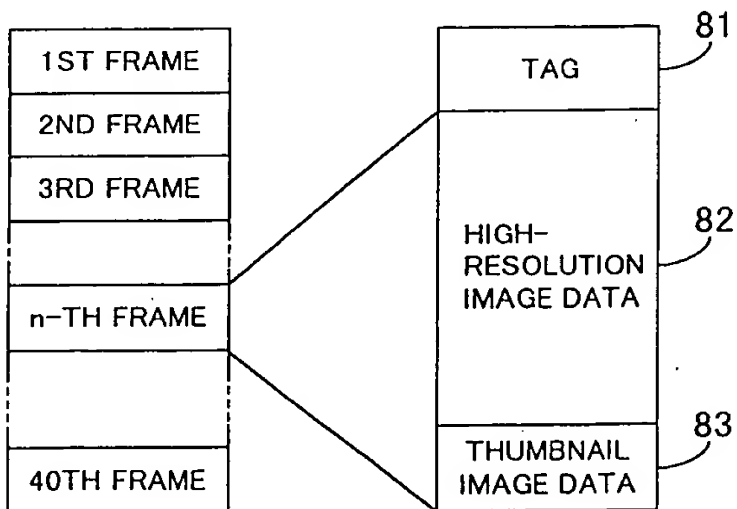


FIG.14

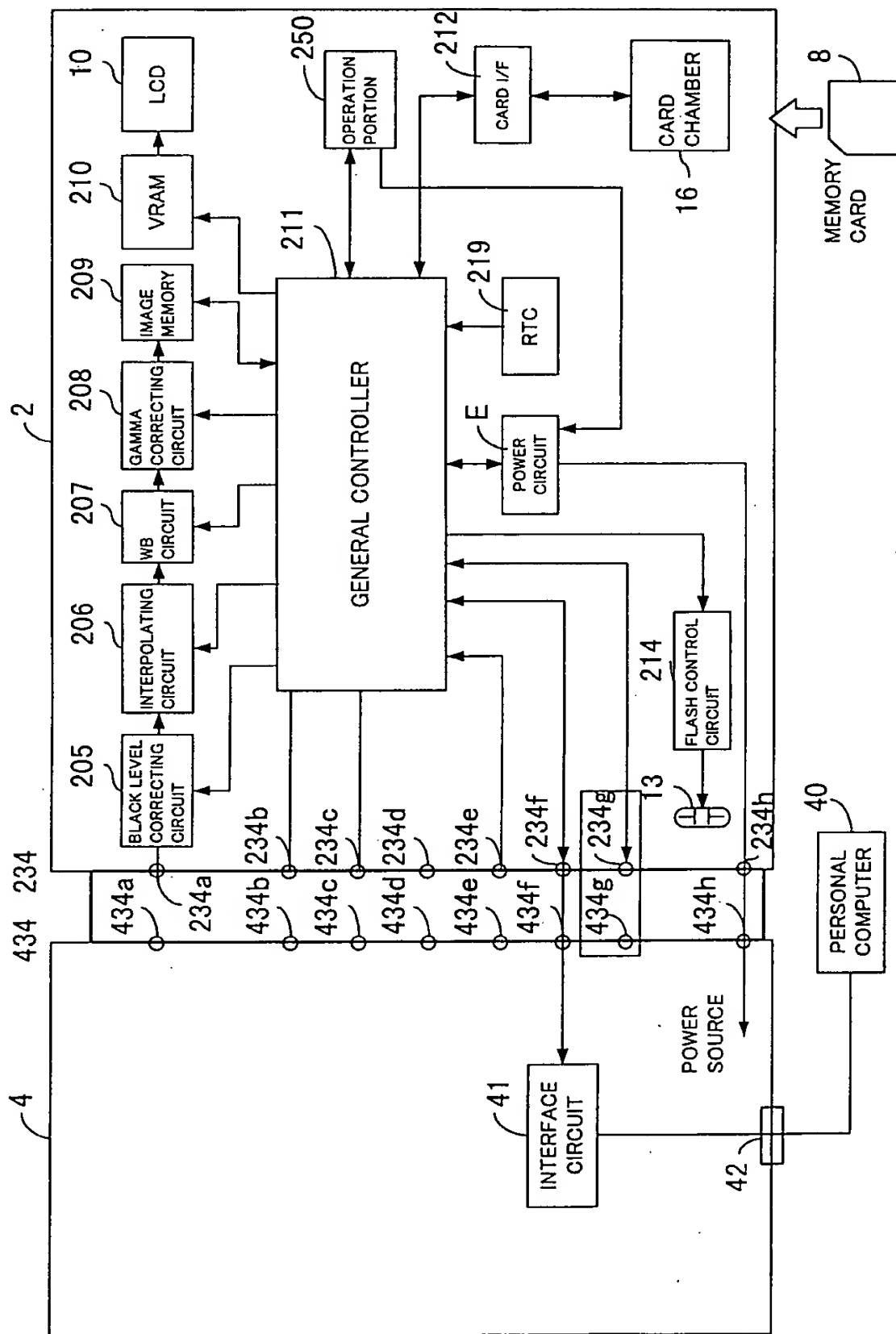


FIG.15

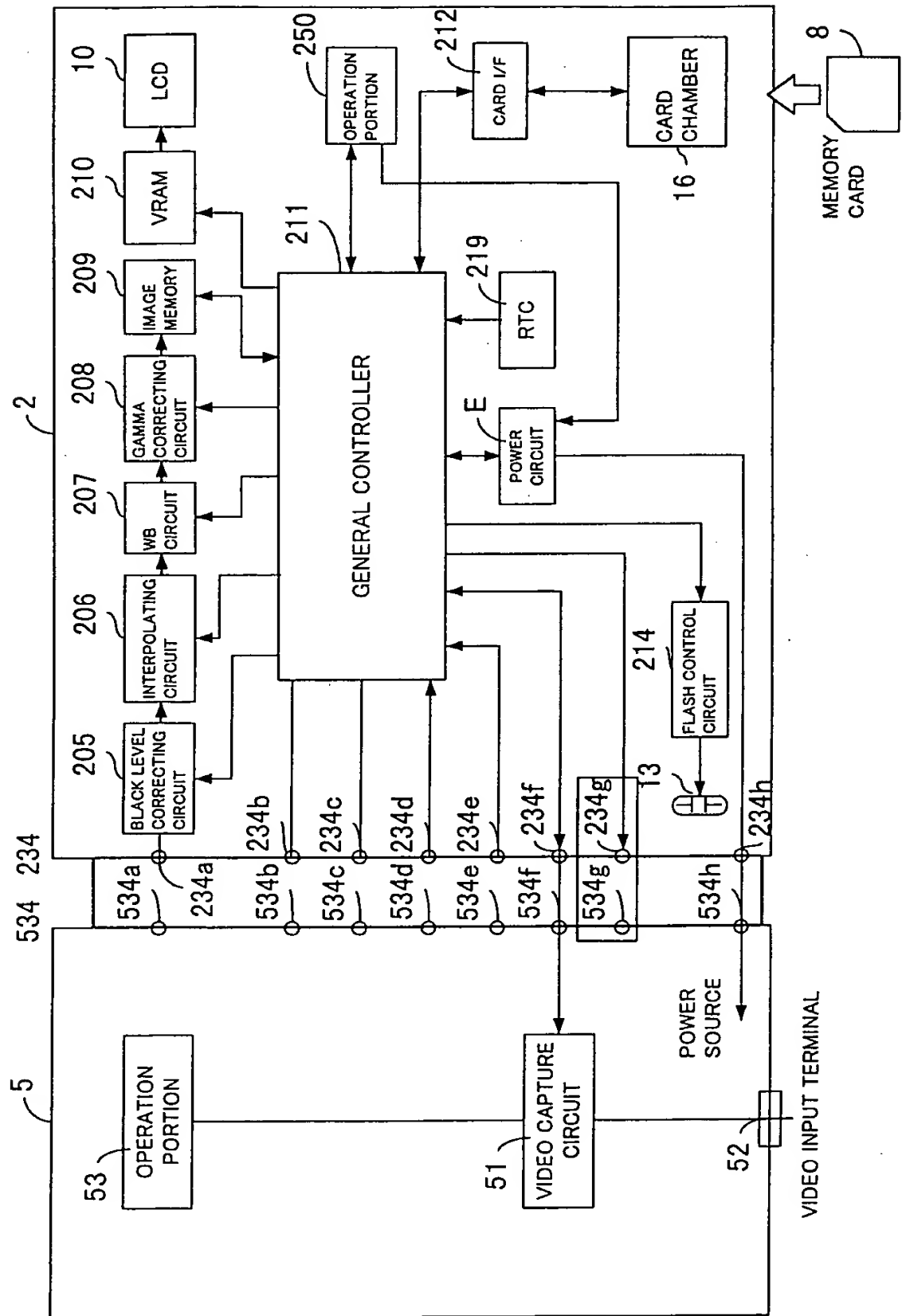


FIG. 16

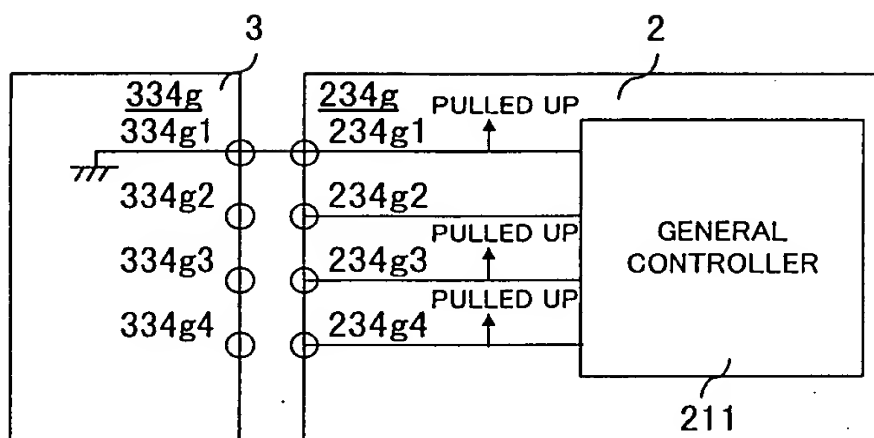


FIG. 17

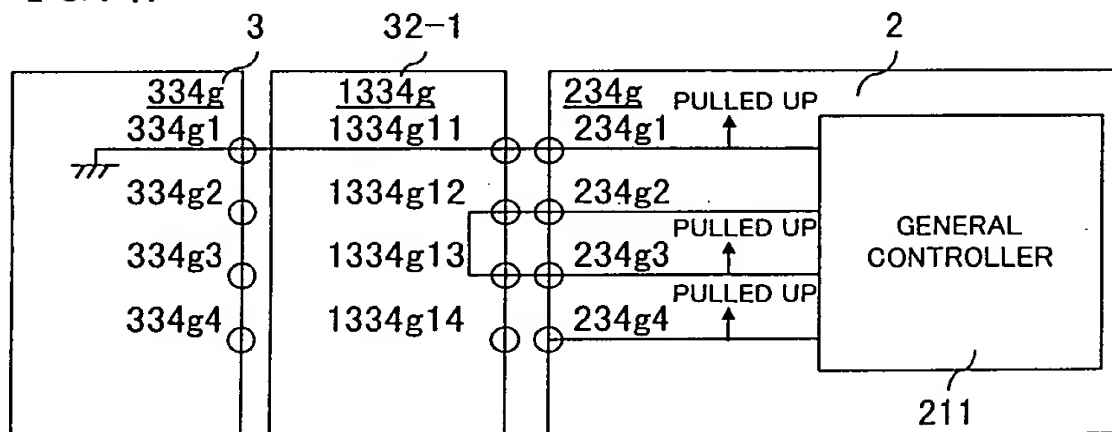


FIG. 18

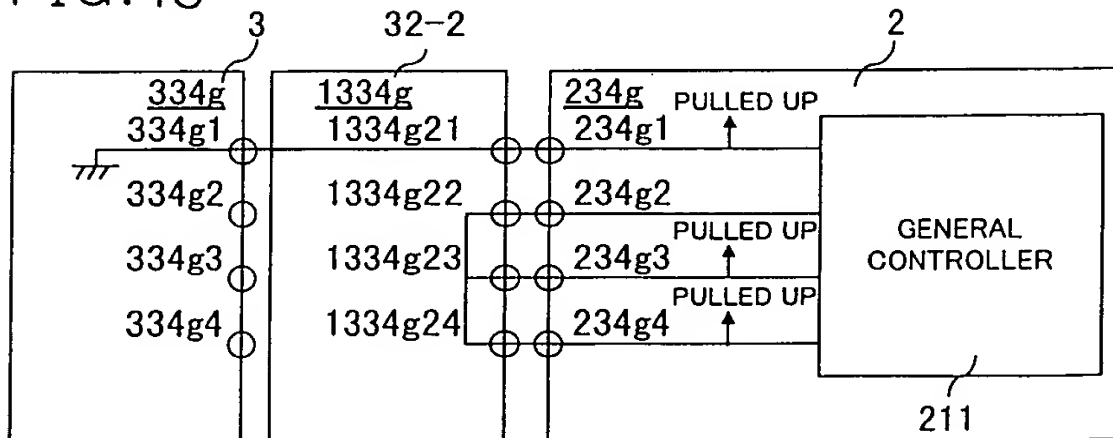


FIG.19

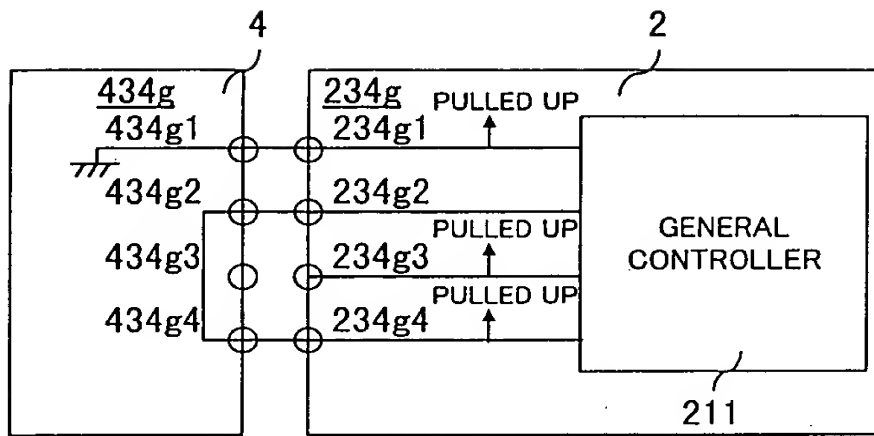


FIG.20

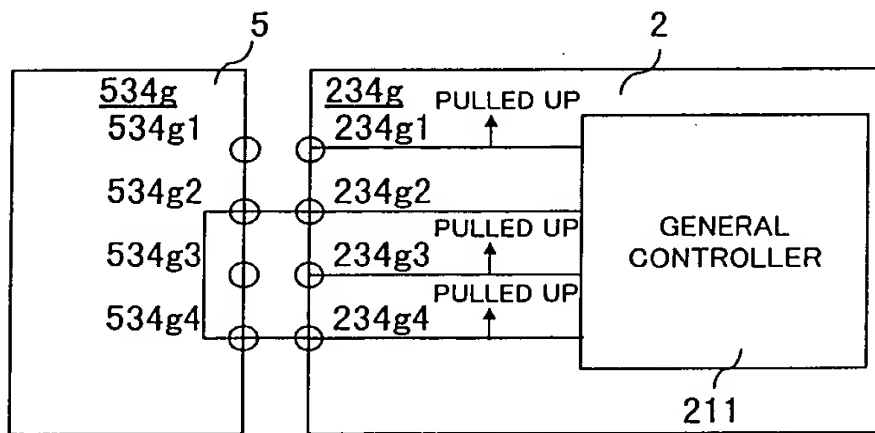
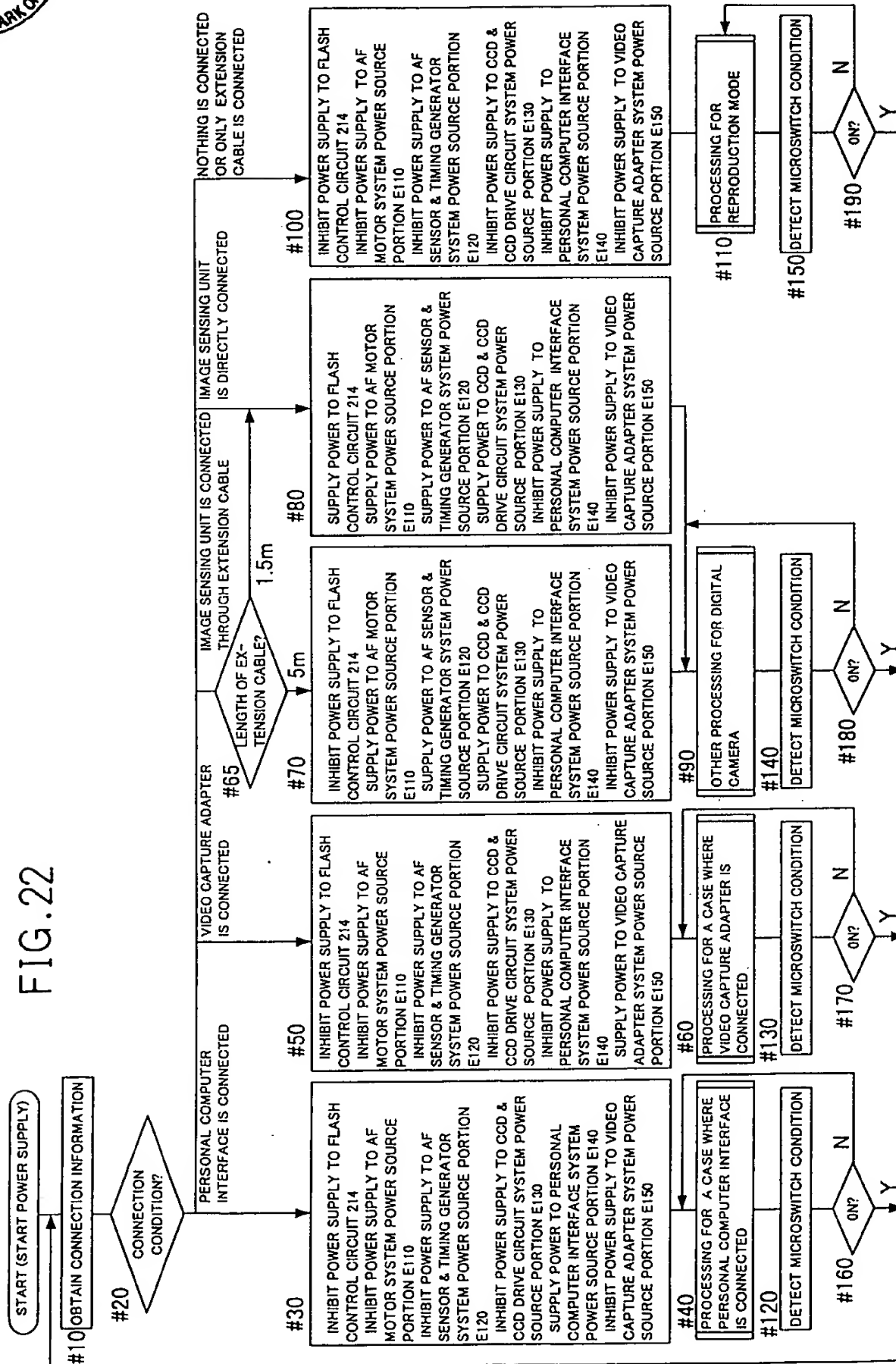




FIG. 21

Condition of connection of accessory to camera body 2	Voltage level of terminal 234g1	Whether there is continuity between terminals 234g2 and 234g3 or not	Whether there is continuity between terminals 234g2 and 234g4 or not
Nothing is connected	High level	No	No
Image sensing unit 3 is directly connected	Low level	No	No
Image sensing unit 3 is connected through 1.5-m extension cable	Low level	Yes	No
Image sensing unit 3 is connected through 5-m extension cable	Low level	Yes	Yes
Only extension cable 32-1 or 32-2 is connected (image sensing unit 3 is not connected)	High level	Yes	Yes (extension cable 32-2) No (extension cable 32-1)
Personal computer interface is connected	Low level	No	Yes
Video capture adapter is connected	High level	No	Yes

FIG. 22





JP App. H10-216709

[Title of the Document] Abstract

[Abstract]

[Object] To provide a digital camera realizing reduction in power consumption.

[Features] In a digital camera, a general controller 211 inside a camera body 2
5 controls, according to the connection state of an image sensing unit 3, the feeding of electric
power to a flash control circuit 214, an AF motor system power source portion E110, an AF
sensor and timing generator system power source portion E120, a CCD and CCD drive circuit
system power source portion E130, a personal computer interface system power source
portion E140 and a video capture adapter system power source portion E150.

10 [Selected Figure] Fig. 10

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